CRUSHING DEVICE

Description

The invention relates to a crushing device configured as a mobile or semi-mobile unit, in particular for use in open cast mining and in the recycling industry, with a feeding container, a feeding conveyor means connected downstream of this for a crusher unit, a discharge conveyor means serving to transport the crushed product therefrom and a support structure, on which the previously named components (feeding container, feeding conveyor means, crusher unit and discharge conveyor means) are held.

Crushing devices of the aforementioned type are used to reduce lump material for crushing, e.g. ores (iron ore, brown ore, copper ore, gold ore), rocks (granite, rock material, gypsum, serpentine, limestone), black coal, bituminous shale, marl, clay and overburden to a given desired particle size. Depending on the working conditions, the crusher units used in particular are hammer crushers, impact crushers, roll crushers, cone crushers, jaw crushers or rotary crushers.

The movability of the crushing devices required with respect to the face advance is assured in this case by the support structure being equipped with caterpillar crawlers, wheel travel gear or walking-type travel gear.

Semi-mobile crushing devices are configured such that they can be shifted in the desired manner

by means of independent transport means, in particular by means of transport crawlers.

In the case of the appropriate crushing devices known hitherto, the crusher unit in many cases has a discharge conveyor means connected downstream of it, which consists of a discharge conveyor disposed below the crusher unit and a drawing conveyor cooperating with it, wherein the latter may also be constructed to be movable relative to the support structure.

The disadvantage of this known configuration is firstly that it has a relatively large mass as a consequence of the use of an additional drawing conveyor, wherein operation of the drawing conveyor requires the use of an appropriate drive means and is associated with an increased expenditure of energy. Secondly, the specifically highly stressed drawing conveyor - its accessibility rendered difficult as a result of its installation position between the crusher unit and the discharge conveyor - is particularly prone to wear and consequently requires repair or maintenance. The resulting relatively short service life of the drawing conveyor therefore has a detrimental effect on the feasibility of the entire crushing device.

Alternatively, appropriate crushing devices have also become known, wherein the discharge conveyor means only comprises a discharge conveyor that is not movable relative to the support structure. Consequently, the crushing device can only be adapted to changing working conditions by the crushing device itself being shifted as a unit, where necessary, and/or additional transport means being used, which cooperate with the relatively fixed discharge conveyor.

The object forming the basis of the invention is to design a crushing device of the aforementioned type such that its feasibility is increased, in particular also by reducing the requirement for maintenance and by improved adaptability to different working conditions. The novel crushing device should also take into account the factor that appropriate mobile or semi-mobile units must be designed to be as "light" as possible because of limited ground pressures.

The set object is achieved by a crushing device with the features of Claim 1.

The fundamental solution concept is therefore to provide the crushes unit with only a single discharge conveyor unit, which is used for both the drawing and the discharge process and which is constructed to slew as a sub-assembly in the horizontal and vertical direction relative to the support structure. In other words, the novel crushing device is configured according to the principle of the "dual conveyor system", wherein the discharge conveyor unit can be slewed laterally as a sub-assembly as well as being vertically adjustable. Within the scope of the invention, the feeding conveyor means, just as the discharge conveyor unit, can be configured virtually as desired, in particular also as an apron feeder, chain conveyor or belt conveyor. The slewing movements of the discharge conveyor means can be actuated by means of any desired drives, in particular by means of hydraulic or electro-mechanical drive means.

The discharge conveyor unit is preferably configured such that it may be slewed during the crushing process (i.e. with the crusher unit in operation) (Claim 2). This assumes that the crushed product exiting from the crusher unit is fed to the take-up section of the discharge conveyor unit in a trouble-free manner - irrespective of its operating position and slewing movements. In the simplest case, the discharge conveyor unit may be slewed laterally around a horizontal movement rotational axis, the position of which is adapted to that of the crusher exit.

The subject of the invention is further configured in that - starting from its straight position, in which it is oriented parallel to the longitudinal extension of the support structure - the discharge conveyor unit can be slewed in horizontal direction respectively around up to 120° in clockwise or counter-clockwise direction (Claim 3).

In addition, within the scope of the invention the discharge conveyor unit should be configured such that - starting from its horizontal position, in which it is oriented parallel to the horizontal plane of reference of the support structure - said discharge conveyor unit can be slewed in an angle range between 30° upwards relative to the horizontal plane of reference and 20° downwards relative to the horizontal plane of reference (Claim 4). A suitable plane, which is fixed by the structure of the crushing device, can be selected as horizontal plane of reference. For example, the transverse plane that runs perpendicular to the longitudinal axis of the crusher unit can be selected as horizontal plane of reference; alternatively, a plane of reference that is predetermined by the axis points of the travel gear or other support elements of the support structure may also be used.

With reference also to the accessibility and freedom of movement of the discharge conveyor unit, the crushing device should be configured in principle such that the crusher unit - and therefore the take-up section of the discharge conveyor unit adjacent to this - assumes an eccentric or also asymmetric position relative to the support structure, as viewed in the longitudinal direction thereof. The crushing device is preferably configured such that the crusher unit, just as the horizontal movement rotational axis of the discharge conveyor unit for its horizontal movement, is disposed in the last third to last quarter of the longitudinal extension of the support structure on the side remote from the feeding container (feeder bin) - viewed in the longitudinal direction of the support structure (Claim 5).

Independently of the above-described embodiment (according to Claim 5) or additionally taking the relevant features into account, on the side remote from the feeding container - viewed in the longitudinal direction of the support structure - the crusher unit may be fastened on a cantilever arm, wherein this runs at a distance above the support elements, via which the support structure is supported on the ground- In this case, the discharge conveyor unit is constructed to slew below the cantilever arm (Claim 6).

Depending on whether the crushing device is configured as a mobile or as a semi-mobile unit, the support elements are formed by a travel gear or walking-type travel gear or by stationary legs resting on the ground. According to the invention, the discharge conveyor unit can either be attached to the cantilever arm to be suspended below it or be mounted below the cantilever arm on another component of the support structure.

A further advantageous embodiment of the subject of the invention is characterized in that the crusher unit and the slewing connection holding the discharge conveyor unit are arranged such that the crusher axis, in the region of which the horizontal movement rotational axis of the discharge conveyor unit is also located, lies behind the support elements - viewed from the feeding container in the longitudinal direction of the support structure and in the direction of the crusher unit - via which support elements the support structure is supported on the ground (Claim 7).

In the variants in question, the crusher unit and the slewing connection of the discharge conveyor unit are displaced outwards an the side remote from the feeding container (feeder bin) in such a manner that they lie outside the region of the support elements for the support structure. The advantage achieved with this in particular is that the dimensions of the crusher unit and the discharge conveyor unit are not dependent on the configuration of the support elements; moreover, the region, in which the discharge conveyor unit is held on the support structure is readily accessible for the purposes of repairs and maintenance, as is the exit region of the crusher unit.

The subject of the invention can also be further developed in that on the side remote from the feeding container - viewed in the direction of the longitudinal extension of the support structure - said support structure has a component in the shape of a "U" with horizontal legs and an opening between the legs directed away from the feeding container. In this case, the crusher unit is disposed on the upper leg, whereas the discharge conveyor unit is held to slew below the crusher

unit in the region of the opening between the legs (Claim 8).

The U-shaped component enables the discharge conveyor unit to either be suspended on the top leg or supported on the bottom leg to allow slewing movement. In this case, use of the component in question is advantageous on the basis that the space defined by the two legs and the connecting web is accessible from both sides as well as from the face side (i.e, from the side opposite the feeding container).

A further variant of the above-outlined embodiment within the scope of the invention is characterized by the following features:
on the side remote from the feeding container - viewed in the direction of the longitudinal extension of the support structure - said support structure has a U-shaped component with horizontal legs and an opening directed away from the feeding container, the U-shaped component being disposed at a distance above the support elements, via which the support structure is supported on the ground.

On the U-shaped component a guide frame is held, which can be slewed around a horizontal movement rotational axis. In addition, the discharge conveyor unit is vertically adjustable relative to the guide frame and is constructed to be capable of following the slewing movement thereof (Claim 9).

Therefore, the variant in question here has a guide frame that may be slewed in horizontal

direction as additional adjusting element. The discharge conveyor unit connects to this in such a manner that it can move in horizontal direction, on the one hand, and can be raised or lowered relative to the guide frame, on the other. The guide frame is preferably configured such that it engages around the U-shaped component of the support structure from the outside, i.e. such that it is supported at the same time on the respective leg above the upper leg, on the one hand, and below the lower leg, on the other.

An advantageous further development of the subject of the invention may be provided in that on the side facing the feeding container, the support structure is configured over a substantial portion of its longitudinal extension, at least in the order of magnitude of 40%, as an open frame with laterally spaced longitudinal beams between the feeding container and the end section of the feeding conveyor means on the crusher side (Claim 10).

As a consequence of the configuration as an open frame, use of an overflow collecting means, which is normally disposed below the feeding conveyor means to protect the area located below it, can be omitted in the respective sub-section of the support structure.

Consequently, additional devices (e.g. drive elements, control elements, power supply means) present in the embodiment with an open frame in question are disposed outside the feeding conveyor means respectively to the side in the region of the longitudinal beam forming part of the open frame. This arrangement is advantageous on the basis that - irrespective of changing working conditions - the crushing device can be subsequently equipped with an overflow

collecting means - in the simplest case, in the form of a channel held below the feeding conveyor means.

The invention shall be explained in detail below on the basis of the drawings, in which heavily schematic views of advantageous embodiments are shown:

Figure 1 is a side view of a crushing device, which is movable by means of a caterpillar crawler, wherein the discharge conveyor unit is shown in two different vertical positions;

Figure 2 is a plan view onto some essential components of the crushing device according to Figure 1;

Figure 3 is a side view shown on an enlarged scale relative to Figure 1 of a part of the support structure (with the caterpillar crawler omitted);

Figure 4 is a side view of a crushing device with a guide frame, which can be slewed laterally relative to the support structure, as mounting for the discharge conveyor unit;

Figure 5 is a plan view onto the caterpillar crawler of the crushing device according to Figure 4, wherein the discharge conveyor means is shown in the straight position and in a position slewed in counter-clockwise direction, and

Figure 6 is a side view of a crushing device with a different mounting for the discharge conveyor unit from that in Figures 4, 5.

The crushing device given the general reference 1 in Figure 1 has the following main components: a feeding container (or feeder bin) 2, a feeding conveyor means in the form of a conveyor belt 3, a support structure 4, which is supported on the ground 6 by means of a caterpillar crawler 5, a crusher unit in the form of a dual-roll crusher 7 and a discharge conveyor unit 8 in the form of a conveyor belt. On the side facing the feeding container 2 - as evident from Figure 3 - the support structure 4 is configured as an open frame, which consists of two spaced longitudinal beams 4a and 4b and also a cross beam 4c connecting these to one another. The conveyor belt housing 3a of the conveyor belt 3 is held on the support structure 4 via a bearing means 4d.

The support structure 4 has a U-shaped component 4e on the side remote from the feeding container 2 (i.e. on the right in Figure 3). This U-shaped component - viewed from the side - is composed of two horizontal legs 4f and 4g with an opening remote from the feeding container 2 and a connecting web 4h. The upper leg 4f is connected to the cross beam 4c on the side facing the feeding container 2 via at least one support rod 9. As is shown schematically in Figure 1, the dual-roller crusher 7 is disposed at a distance above the discharge conveyor unit 8, which it self connects to the lower leg 4g of the U-shaped component 4e so that it can be slewed in horizontal and vertical direction.

For this purpose, the discharge conveyor unit 8 is articulated via a vertical movement axis 10 (lying perpendicular to the plane of the drawing) to a rotary bracket 11, which is itself capable of slewing movement around the longitudinal axis 7a of the dual-roll crusher 7 relative to the lower leg 4g.

As may be seen from Figure 1, - starting from its horizontal position, in which it is oriented parallel to a horizontal plane of reference (e.g. to the transverse plane to the longitudinal axis 7a) of the support structure 4 - the discharge conveyor unit 8 can be slewed around the vertical movement axis 10 in counter-clockwise direction; in the case of the shown slewing position 8', the slewing angle achieved amounts to 12°. The rotary bracket 11 enables the discharge conveyor unit 8 to slew in horizontal direction relative to the support structure 4. Figure 2 shows a slewing position 8" of the discharge conveyor unit 8, which - starting from the straight position, in which the discharge conveyor unit is oriented parallel to the longitudinal extension of the support structure 4 - has been achieved by a slewing movement in clockwise direction around 75°.

The view in question additionally shows that additional means 12a to 12c (e.g. for drive means, control means, power supply means) are respectively disposed laterally next to the longitudinal beams 4a and 4b. Consequently, overflowing material produced in the region of the conveyor belt 3 can exit downwards practically unhindered so that - as may be seen in Figure 1 - the use of an overflow collecting means below the conveyor belt 3 is unnecessary.

Moreover, it may be seen from Figure 1 that the dual-roll crusher 7 and the slewing connection of the discharge conveyor unit 8 are disposed on the side remote from the feeding container 2 approximately in the last quarter of the longitudinal extension of the support structure 4 with the result that the region between the dual-roll crusher 7 and the lower leg 4g with the rotary bracket 11 is readily accessible, in particular also for maintenance purposes.

In the direction of the discharge conveyor unit 8, the dual-roll crusher 7 is equipped in a manner known per se with a discharge hopper 7b, which projects to a lesser or greater distance into a channel-shaped take-up section 8a of the discharge conveyor unit 8.

The crushed product obtained by means of the dual-roll crusher 7 passes onto the discharge conveyor unit 8 via the intermediate connection of parts 7b and 8a, and can be transferred to an ongoing transport belt 13 by means of this conveyor unit. A driver's cabin 15 is provided above the support structure 4 on support elements 14 of no further interest here.

Within the framework of the invention, the freedom of movement of the discharge conveyor unit 8 may be extended by appropriate configuration and arrangement of parts 10 and 11 such that the discharge conveyor unit 8 can also be slewed downwards relative to the support structure 4 - starting from the horizontal position shown in Figure 1.

Moreover, the discharge conveyor unit 8 can also be moved in counter-clockwise direction (i.e. upwards in the drawing) - starting from the straight position shown in Figure 2.

The embodiment of the crushing device shown in Figures 4 and 5 L is equipped with a multiple-crawler travel gear 16, the three crawler pairs 16a of which are held to slew on a travel gear platform 16b. The support structure 4 is movably mounted on this platform via a rotary connection 16c.

In contrast to the previously described embodiment, on the side remote from the feeding container 2 - viewed in the direction of the longitudinal extension of the support structure - said support structure 4 is equipped with a cantilever arm 4i angled upwards in this direction, which projects far beyond (to the right in the drawing) the multiple-crawler travel gear 16 and is fastened to one crusher unit in the form of a dual-roll crusher 7.

In this case, the dual-roll crusher 7 assumes a position relative to the multiple-crawler travel gear 16, in which the crusher axis 7a - on the side of the crushing device 1 remote from the feeding container 2 - lies at a distance in front of the two front crawler pairs 16. Similar applies with respect to the arrangement of the articulated connection for the discharge conveyor unit 8, which is shown in Figure 4 in two different vertical positions 8' and 8'''.

As may also be seen from Figure 4, the support structure 4 is equipped with an angled arm 4k - lying in front of the dual-roll crusher 7 viewed from the feeding container 2; components 4i and 4k in turn together form a laterally open, approximately U-shaped component with a face-side opening directed away from the feeding container 2, in which the dual-roll crusher 7 is disposed.

Above and below the U-shaped component on the angled arm 4k or the cantilever arm 4i, a guide frame 17 is mounted to slew in horizontal direction, the frame axis 17a of which coincides with the crusher axis 7a.

Below the guide frame 17, the discharge conveyor unit 8 is held via a rotary bracket 11 to be vertically adjustable around a vertical movement axis 10.

For the purpose of vertical adjustment relative to the guide frame 17, the discharge conveyor unit is equipped on both sides with guide rods 18 articulated thereon; these in turn connect to retractable and extendable cylinder units 19, which are articulated on the guide frame 17 above the angled arm 4k. By retracting or extending the cylinder units 19, the vertical position of the discharge conveyor unit can be infinitely varied relative to the guide frame 17.

Two different vertical positions of the discharge conveyor unit relative to a horizontal plane of reference 20 are shown in Figure 4. In the vertical position with the reference 8 ' , the discharge conveyor unit is slewed upwards by about 10°; contrary to this, the discharge conveyor unit assumes a position slewed downward by about 10° in the vertical position with the reference 8'''.

It is self-evident that the parts 18 and 19 must be configured -- such that the discharge conveyor unit follows the movement of the guide frame 17 perfectly around its frame axis 17a also in operating mode.

In the shown embodiment, the horizontal plane of reference is oriented parallel to the plane of the rotary connection 16c, via which the support structure 4 is movably held relative to the multiple-crawler travel gear 16.

As a consequence of the movable arrangement of the guide frame 17, the discharge hopper 7b of the dual-roll crusher 7 merges below the cantilever arm 4i into a transfer head 7c, which is likewise held on the cantilever arm 4i to slew around the crusher axis 7a.

Where necessary, the crushing device 1 (as indicated in Figure 4) can be additionally or subsequently equipped with a channel-type overflow collecting means 21, which runs below the conveyor belt 3 in the region between the feeding container 2 and the dual-roll crusher 7, In the embodiment, the overflow collecting means is supported on the ground 6 in the vicinity of the feeding container 2 via a support means 21a on one side, and held in the vicinity of the dual-roll crusher 7 on the other. Figure 5 shows the position and mutual arrangement of the three crawler pairs 16a forming the multiple-crawler travel gear 16 and the position of the rotation point 16d of the rotary connection 16c.

The figure additionally shows the straight position of the discharge conveyor unit 8, in which this is oriented parallel to the longitudinal extension of the support structure 4, and additionally a position given the reference 8"", which the discharge conveyor unit assumes after slewing in counter-clockwise direction around approximately 60° - starting from its L straight position. The advantage of the embodiment according to Figures 4 and 5 is primarily that with its

attachment to the support structure 4 the discharge conveyor unit 8 is disposed completely outside the region of the multiple-crawler travel gear 16 and is therefore readily accessible for the purposes of repairs and maintenance. Similar applies to the accessibility of the dual-roll crusher 7 and the respectively associated further components - in view of the laterally open configuration of the U-shaped component comprising the arms 4i and 4k.

Moreover, the freedom of movement of the discharge conveyor unit 8 - as a consequence of the already mentioned "eccentric" arrangement on the support structure 4 - can also be designed to be relatively high in vertical direction, as a result of which the range of use and feasibility of the crushing device 1 increase accordingly.

The embodiment shown in Figure 6 differs from the previously explained embodiment in that no guide frame is present. Instead of this, the discharge conveyor unit 8 is held above the dualroll crusher 7 on a cylinder unit 21, which can be moved, on the one hand, around a vertical axis 21b and, on the other, around a (not shown) horizontal axis 21c (oriented perpendicular to the plane of the drawing). The vertical axis 21b coincides with the crusher axis 7a in the shown embodiment.

The cylinder unit 21 is articulated to the cross beam 22a via its retractable and extendable piston rod 21a. Push rods 22 and cable rigging 23a or 23b articulated on both sides of the discharge conveyor unit 8 extend from this cross beam. The mounting of the discharge conveyor unit in question is therefore configured such that - starting from a horizontal plane of reference

20 - said conveyor unit can be raised by retracting the cylinder unit 21 into the vertical position with the reference 8' or can be lowered by extending it into the vertical position with the reference 8'''.

With the retracting and extending movement of the cylinder unit, this is simultaneously slewed around the horizontal axis 21c. The vertical axis 21b enables the discharge conveyor unit to be moved relative to the support structure 4 into or out of the plane of the drawing, in which case under the action of components 22, 22a, 23a and 23b, the cylinder unit 21 follows the slewing movement of the discharge conveyor unit 8 around the vertical axis 21b.

The slewing movement relative to the last-mentioned vertical axis is actuated by a motor-driven ball bearing swivel joint (not shown) provided below the dual-roll crusher 7 on the cantilever arm 4i.

With respect to the further components and the resulting configuration of the crushing device, reference is made to the embodiment according to Figures 4 and 5.

The solution concept according to the invention may fundamentally be applied irrespective of how the crusher unit, the feeding conveyor means, the discharge conveyor unit and the devices used for operation as a mobile or semi-mobile unit are otherwise configured.

In particular, the feeding conveyor means and the discharge conveyor unit may also be

configured - possibly also differing one from the other - as apron feeder, chain conveyor or belt conveyor.